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GREAT LAKES FORESTRY CENTRE
CENTRE FORESTIER DES GRANDS LACS

Results of forest insect and disease surveys in the EASTERN REGION of Ontario, 1986

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

C. G. Jones

Miscellaneous Report No. 55

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THE GREAT LAKES FORESTRY CENTRE

The Great Lakes Forestry Centre is one of six regional centres located across Canada and operated by the Canadian Forestry Service. The Service provides federal leadership and a national focus in the forestry sector for the continuing economic, social and environmental benefit of Canadians. The Centre conducts two major programs: research and technical services, and forestry development. Both programs address major problems affecting forest management and the forested environment in Ontario. Because of the transprovincial nature of the forest resource, many elements of the research program are of national significance.

For many years the research program was guided by the Canada-Ontario Joint Forestry Research Committee, made up of senior members of the Centre and the Ontario Ministry of Natural Resources. Responsibilities for coordinating all forestry research in Ontario have now been assumed by the Ontario Forestry Research Committee, which has representatives from forest industry, universities and federal and provincial governments. This Committee also ensures that research results are transmitted to forest managers.

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The Centre recognizes that forested land must be managed in the best public interest, not only for the wood production essential to our economy but also for the recreational purposes that are so important to our social well-being. These goals must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE EASTERN REGION OF ONTARIO, 1986

(FOREST DISTRICTS: NAPANEE, TWEED, CARLETON PLACE, CORNWALL AND BROCKVILLE)

C.G. JONES

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

1987

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SURVEY HIGHLIGHTS

The following report reviews the more important insect, disease and abiotic conditions encountered during aerial and ground surveys of the forested areas in the Eastern Region in 1986.

The total area of moderate-to-severe defoliation caused by the gypsy moth was 166,974 ha, a 32% reduction from the previous year; egg-mass surveys indicate that population decreases may continue in 1987. A total of 103,094 ha of private and crown land was aerially sprayed against the gypsy moth by the Ontario Ministry of Natural Resources (OMNR) in the Central, Algonquin and Eastern regions, the bulk of the spraying program being conducted in the Eastern Region.

High populations of the redheaded pine sawfly were recorded in each district and associated mortality was observed in Brockville and Carleton Place districts. High numbers of the jack pine sawfly were encountered in Brockville, Carleton Place and Tweed districts. Widespread moderate-to-severe defoliation of their respective host species was caused by the eastern tent caterpillar and the fall webworm. Branch mortality of beech caused by the oystershell scale was observed in Carleton Place and Cornwall districts.

Aerial and ground surveys were conducted for Scleroderris canker, but none was detected. The extremely wet summer provided excellent conditions for the proliferation and spread of anthracnose and other leaf diseases. High winds caused single and multiple tree damage or blowdown, and frost damage was encountered across the region.

Special surveys done in 1986 include the evaluation of six eastern white pine plantations for specific insect and disease problems, the collection of 100 cones from an eastern white pine Seed Collection Area to determine the type of cone pests and the examination of six stands of sugar maple to assess the status of crown dieback. The oak decline plots in Carleton Place District were retallied.

As in previous years, pests in this report are categorized as follows:

Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Frontispiece

Defoliation caused by the gypsy moth, *Lymantria dispar* L.

Damage caused by the redheaded pine sawfly, *Neodiprion lecontei* (Fitch)

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been shown to cause serious damage to forest trees,

(2) those that are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1986

Note: Forest districts are listed below the insect, disease or abiotic problem found in that particular district.

The valuable assistance and cooperation extended to the author by OMNR, Conservation Authorities and Parks Canada during the 1986 field season is gratefully acknowledged.

C.J. Jones

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INSECTS

Major Insects

Pine False Webworm, *Acantholyda erythrocephala* (L.)

Distribution of this pest was widespread in the region but associated damage was light. The low populations encountered in 1986 were comparable with those of the previous year.

Four areas were evaluated to determine the incidence and impact of this pest. The highest numbers were recorded in Marlborough Township, Carleton Place District, where assessment disclosed that 55% of the 4.5-m red pine (*Pinus resinosa* Ait.) in a 2-ha plantation were attacked, and there was an average of three web masses per affected tree (see photo page). Related defoliation was light over all, but several trees under 2 m experienced severe defoliation (>50%).

A red pine plantation and two plantations of eastern white pine (*Pinus strobus* L.) were also evaluated. The results are summarized in Table 1.

Table 1. Summary of European pine sawfly web-mass counts at four locations in the Eastern Region in 1986 (counts based on the examination of 150 trees at each location).

Location (Twp)	Host	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	Trees affected (%)	Avg no. of webb masses per tree
Carleton Place District						
Marlborough	rP	4.5	1,200	2	55	3
Darling	wP	2.0	2,116	4	2	1
Tweed District						
Madoc	rP	3.0	3,100	2	36	2
Brockville District						
Augusta	wP	1.4	2,350	3	7	1

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

The results of damage surveys, population sampling and egg-mass counts will be included with those of other regions in a separate report to be published at a later date. This report will provide a complete description and analysis of developments in the spruce budworm situation in Ontario in 1986 and will give infestation forecasts for the province for 1987.

Larch Casebearer, *Coleophora laricella* (Hbn.)

In routine surveys, only two small areas of moderate-to-severe defoliation were detected in the region. Populations had been increasing in some stands in the Brockville and Carleton Place districts over the past two years but no widespread areas of high populations materialized in 1986.

Moderate numbers of larvae were recorded in a 5-ha stand of 7-m tamarack *(Larix laricina* [Du Roi] K. Koch) in Elizabethtown Township, Brockville District that had been assessed the previous year. In 1985, counts disclosed 32 casebearers per 45-cm branch tip while in 1986 this figure declined to 24. A defoliation estimate of 40 3-m roadside trees in South Gower Township, Brockville District, revealed an average defoliation of 60%.

Low numbers were encountered in a 1-ha plantation of 3-m European larch *(Larix decidua* Mill.) in Gloucester Township, Carleton Place District, where counts revealed an average of six casebearers on each 45-cm branch tip.

Maple Trumpet Skeletonizer, *Epinotia aceriella* (Clem.)

Populations decreased and distribution was not as widespread as in the previous year.

High populations were observed at two locations in Hallowell Township, Napanee District. Assessment in one 2-ha area disclosed 50% average defoliation of 21-m dominant and codominant sugar maple *(Acer saccharum* Marsh.) and 80% foliar damage on understory trees less than 10 m in height. At the other location a 5-ha stand of 21-m trees was damaged. Defoliation averaged 10% on overstory trees but increased to 80% on trees under 10 m in height. Low populations were detected in other stands of sugar maple throughout Prince Edward County, Napanee District.

Birch Leafminer, *Fenusa pusilla* (Lep.)

Moderate-to-severe foliar damage of ornamentals and forest trees was widespread in 1986. The heaviest damage to ornamentals was observed in residential areas along the St. Lawrence River and Lake Ontario from Cornwall to Colborne but moderate-to-severe foliar damage of ornamentals could be found in most developed areas in the region.

The following field observations typify the regional situation. Evaluations disclosed that 100% of a 5-ha stand of 15-m trees in Williamsburgh Township, Cornwall District, experienced average foliar damage of 25%. Assessment also revealed 60% defoliation of a 0.5-ha stand of 5-m white birch *(Betula papyrifera* Marsh.) in East Hawkesbury Township, Cornwall District. Similar damage was observed in a 5-ha stand of 6-m trees in Oxford on Rideau Township, Brockville District, and throughout forested areas in Napanee and Tweed districts.

Sugar Maple Borer, *Glycobius speciosus* (Say)

Four stands of sugar maple were assessed to determine the impact of this insect, considered the worst pest of maple in Canada. The tunnels of the wood-boring larvae are confined mainly to the most valuable part of the stem. These tunnels also inhibit sap movement and contribute to a lessening of tree vigor (see photo page).

Examination of a 10-ha stand of 24-m sugar maple in Goulbourn Township, Carleton Place District disclosed that 17% of the trees were attacked, and in a 50-ha stand in Pakenham Township, Carleton Place District a survey revealed that 7% of the 21-m trees were damaged. Assessment of a 15-ha stand of 19-m trees in Oxford on Rideau Township, Brockville District showed that 9% of the trees were affected and 2% of 25-m sugar maple in a 20-ha stand in Effingham Township, Tweed District were attacked.

Fall Webworm, *Hyphantria cunea* (Dru.)

High populations were recorded for the sixth consecutive year in the region. The highest numbers were confined mainly to roadside and fencerow trees and fringe trees in low-lying areas. Black ash (*Fraxinus nigra* Marsh.) and white elm (*Ulmus americana* L.) were the species most commonly affected.

Medium-to-heavy infestations were observed at several locations in the Cornwall District. Examination of a 1-ha stand of ash ranging in height from 2 m to 15 m in Lancaster Township disclosed that 32% of the trees were affected, and that there was an average of two tents per tree. A survey of 60 roadside willow (*Salix* spp.) in Charlottenburgh Township showed that 15% of the trees had been attacked, and that there was an average of one tent per tree. Elsewhere in Cornwall District moderate-to-severe defoliation of trees in small areas, less than 1 ha in size, was recorded in Williamsburgh, Osnabruck and East Hawkesbury townships, where counts disclosed as many as 15 tents on 4-m trees and 30 tents on 15-m trees.

Assessment of 30 fencerow ash (*Fraxinus* spp.) 3 m high in Hungerford Township, Tweed District revealed that 30% of the trees had been attacked, and that there was an average of three tents per tree.

Counts done in Fitzroy Township, Carleton Place District, showed that as many as 10 tents on 10-m ash were common in low-lying areas less than 1 ha in size. Elsewhere in Carleton Place District high populations were observed in Ramsay and Bathurst townships.

Moderate-to-severe defoliation of several areas less than 1 ha in size was recorded in Edwardsburgh Township, Brockville District. Seven tents on 5.0-m ash were common in these areas.

Gypsy Moth, *Lymantria dispar* (L.)

A decline in the area of medium-to-heavy infestation was recorded for the first time in the region since 1981, when the pest was first detected causing moderate-to-severe defoliation (Frontispiece and Fig. 1). Aerial surveys revealed 166,974 ha of medium-to-heavy infestation, a 32% reduction from the 245,987 ha recorded in 1985 (Fig. 2). Oak (*Quercus* spp.) was the preferred host.

The largest area of population collapse occurred in the central portion of Tweed District, in the older, previously infested areas south of Big Gull Lake and west of Highway 38. Other areas of significantly decreased populations in the Tweed District were observed in the Mount Moriah and Lingham Lake areas in Grimsthorpe Township and in Marmora and Madoc townships. Although there was some expansion in areas of previously moderate-to-severe defoliation in Lake and Abinger townships, the area of moderate-to-severe defoliation in Tweed District was reduced from 172,232 ha in 1985 to 73,525 ha in 1986. In Table 2 the areas of defoliation for 1985 and 1986 are compared by OMNR district and in Table 3 the area of moderate-to-severe defoliation is listed by county.

New or increased areas of medium-to-heavy infestation were mapped in Napanee District in Sidney, Sophiasburgh and Cramahe townships and on Howe and Wolfe islands but the total area infested decreased by 546 ha from 1985.

A doubling in the area of medium-to-heavy infestation was recorded in the Brockville District. Increases were observed along the leading edge of the infestation in North Crosby Township and in the Chaffeys Locks-Jones Falls area in South Crosby Township, south of Gananoque Lake and Leeds and Lansdowne Township and around Charleston Lake.

The area of moderate-to-severe defoliation in Carleton Place District tripled over that of 1985. Increases were observed in South Sherbrooke and Lavant townships and near Constance Bay in Torbolton Township.

No medium-to-heavy infestations were recorded in the Cornwall District although low numbers were collected in Hawkesbury, Alfred, Lochiel and Lancaster townships.

A mortality cruise was conducted in the area where the infestation was first detected in 1981. Trees at this location have been subjected to six years of continuous moderate-to-severe defoliation. A total of 100 oak--(18 white oak (*Quercus alba* L.) and 82 red oak (*Q. rubra* L.)--each >10 cm DBH, were examined on a 3-m-wide path along a randomly selected azimuth. The mortality assessment revealed seven dead red oak.

Whether these trees succumbed as a direct result of defoliation by the gypsy moth could not be determined. Certainly, the gypsy moth has been a contributing factor, but site, tree age, disease and other insects should also be considered.

Red oak mortality or decline as discussed later in this report has been a recognized problem for a number of years in this region. Two plots were established in 1977 in Lavant Township, Carleton Place District to monitor this decline. Since 1981, 6% and 7% of the trees in Plot 1 and Plot 2, respectively, have died. (Some succumbed to wind damage but mortality was due mainly to other biotic and abiotic factors.) Moderate-to-severe defoliation was recorded in Plot 1 for the first time in 1986 and only small numbers of gypsy moth have ever been recovered from Plot 2.

A total of 103,094 ha, 45,677 ha of crown and 57,417 ha of private land, was treated by OMNR with two or three applications of the bacterial insecticide *Bacillus thuringiensis (B.t.)* in Brockville, Carleton Place, Napanee and Tweed districts in the Eastern Region, Pembroke District in the Algonquin Region and Lindsay District in the Central Region.

Larval and adult populations were monitored at 13 provincial parks. Larvae were recovered by means of a burlap strip tied around the trunks of 10 deciduous trees at each location and adults were captured with a sticky trap and a pheromone-impregnated strip. Adults were trapped at each of the provincial parks and, except for Ferris Provincial Park in Seymour Township, Napanee District, larvae were trapped at each location (Table 4).

A cooperative egg-mass survey was conducted by OMNR and Canadian Forestry Service (CFS) personnel at 202 plots (each .01 ha in size) in the Central, Algonquin and Eastern regions. Comparison of egg-mass densities in 85 of these plots examined in both 1985 and 1986 in Pembroke District, Algonquin Region and Brockville, Napanee and Tweed districts, Eastern Region revealed an overall reduction of 82%. Line searches, a quick method of detecting and recording egg masses, were conducted at 257 locations, and in 157 areas surveyed the previous year the number of egg masses recorded decreased over all by 39%.

Factors contributing to the decline in gypsy moth populations include adverse weather conditions, parasites, predators, disease and possibly the 1986 aerial spraying program.

The area of moderate-to-severe defoliation will probably continue to decline in the Eastern Region in 1987. High populations can be expected in the area shared by the western part of Brockville District and the eastern part of Napanee District, namely in the vicinity of Charleston Lake, Marble Rock, South Lake, Buck Lake, Canoe Lake and Bob's Lake; the Constance Bay area and north of Flower Station in Carleton Place District; McLean, Tweed, Crotch Lake and Mount Moriah and between Gull Lake and Kashwakamak Lake in Tweed District.

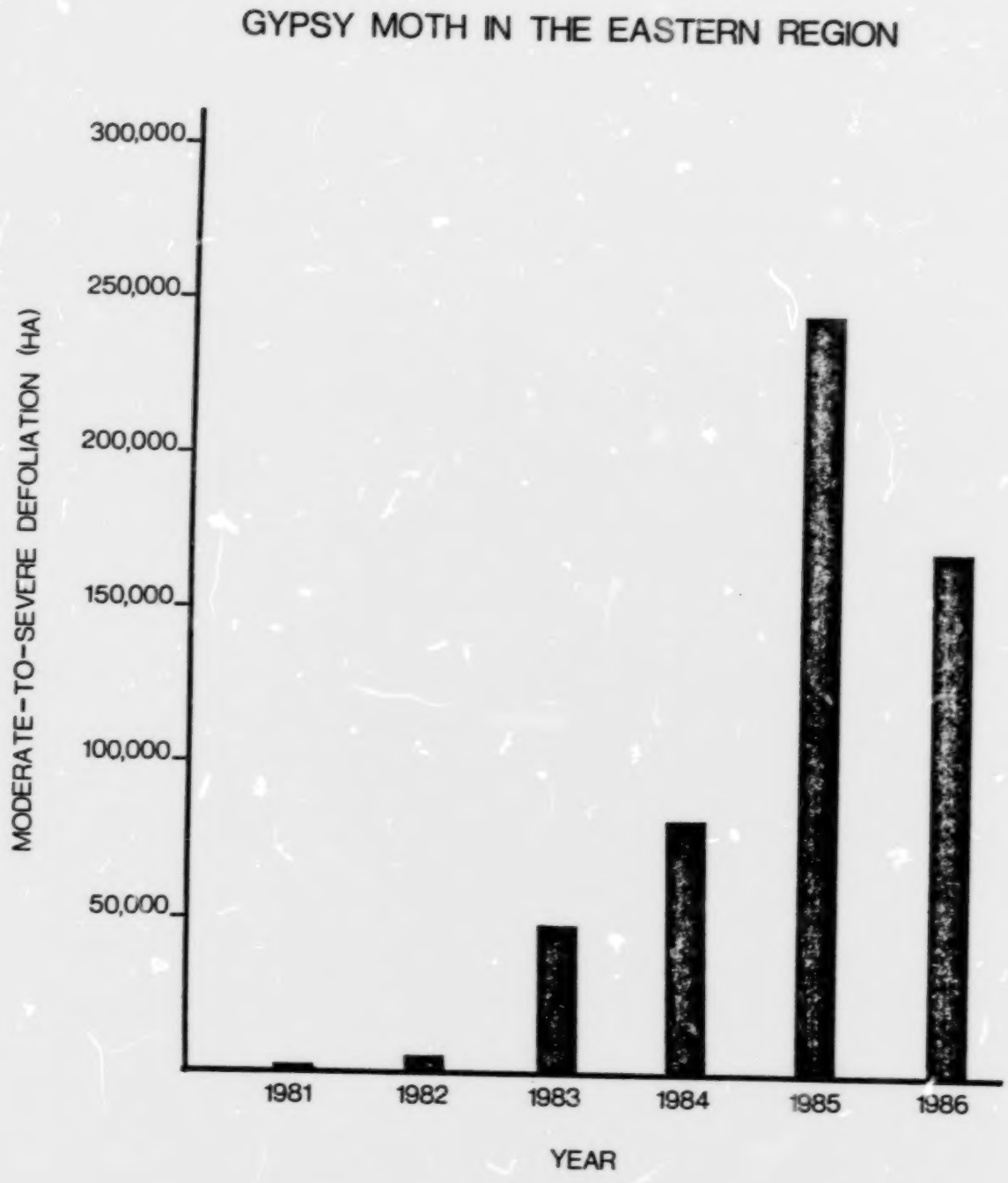


Figure 1. Area of damage caused by the gypsy moth(*Lymantria dispar*[L.]) over a 6-year period in the Eastern Region

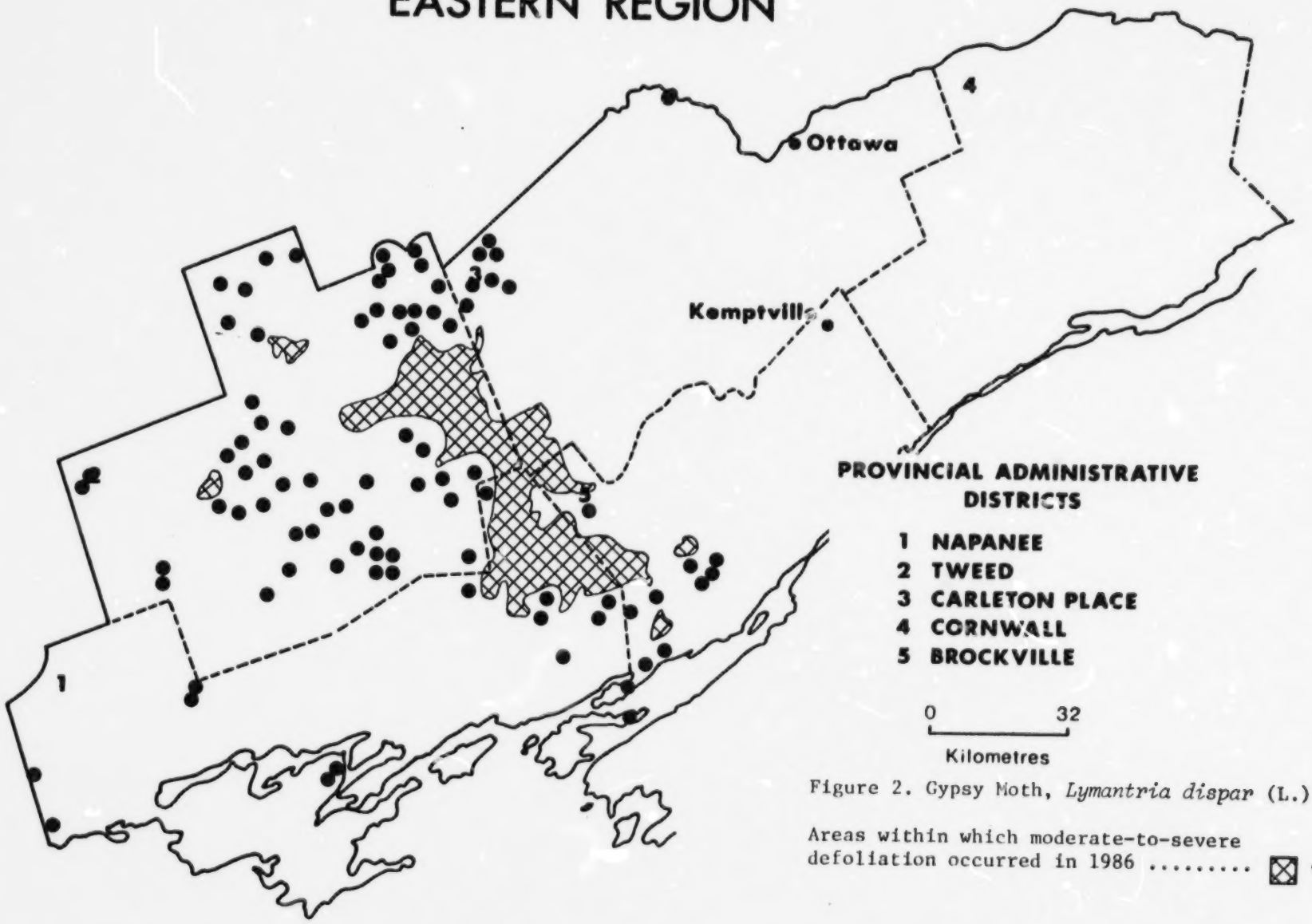


Figure 2. Gypsy Moth, *Lymantria dispar* (L.)

Areas within which moderate-to-severe defoliation occurred in 1986 ..... ⊠ or ●

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 2. A comparison of the gross area (ha) of moderate-to-severe defoliation by the gypsy moth in 1985 and 1986 in the Eastern Region.

District	1985	1986	Change
Tweed	172,232	73,525	- 98,707
Napanee	58,326	57,780	- 546
Carleton Place	4,197	13,386	+ 9,189
Brockville	11,232	22,283	+ 11,051

Table 3. A summary of moderate-to-severe defoliation by the gypsy moth in eight counties in the Eastern Region in 1986.

Location (county)	Area (ha)
Frontenac	109,442
Leeds	22,283
Lanark	13,356
Hastings	11,668
Lennox and Addington	8,627
Northumberland	1,430
Prince Edward	540
Ottawa-Carleton	30

Table 4. A summary of the results of the gypsy moth pheromone and burlap trapping program conducted at 13 provincial parks in the Eastern Region in 1986.

Location (Provincial Park)	Burlap traps		Pheromone traps		
	No. of traps	Results	No. of traps	No. of male moths caught	
				1985	1986
Brockville District					
Charleston Lake	10	positive	2	53	56
Carleton Place District					
Fitzroy	10	positive	2	68	60
Murphy's Point		not trapped	2	93	37
Rideau River	10	positive	2	23	76
Silver lake	10	positive	4	84	84
Cornwall District					
Carillon	10		2	45	20
Napanee District					
Ferris	10	negative	2	30	22
Frontenac	10	positive	6	0*	171
Lake on the Mountain		not trapped	2	30	40
Presquile	10	positive	2	67	42
Sandbanks	10	positive	2	96	31
Tweed District					
Bon Echo			6	0	145
Sharbot Lake			12	35	287

* indicates one or more traps were lost or destroyed

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Populations of this pest continued to increase in 1986 and high populations were found at widely separated areas in the region (see Frontispiece). The highest number of infested plantations occurred in the central portion shared by Brockville and Carleton Place districts (Fig. 3).

The highest single area of damage occurred in a 0.5-ha plantation of 1.7-m red pine in Huntington Township, Tweed District, where 59% of the trees were attacked and there was an average of two colonies per

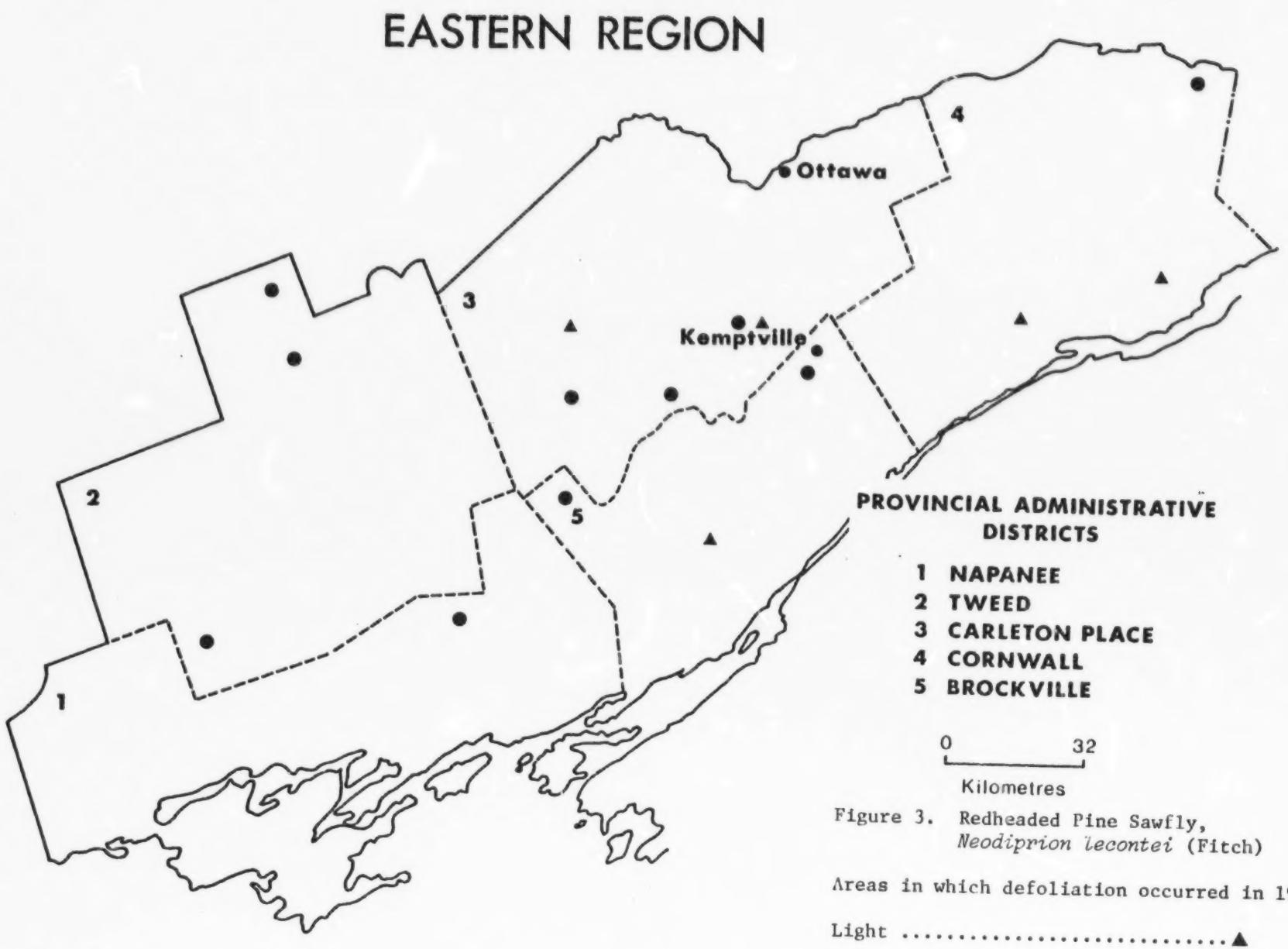


Figure 3. Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Areas in which defoliation occurred in 1986

Light .....▲

Moderate-to-severe .....●

tree. Eight other areas were also assessed and the results are summarized in Table 5.

Other areas of defoliation were observed but no damage assessments were conducted. "Hot spots" or small pockets of moderate-to-severe defoliation were detected in a 2-ha plantation of 1.5-m red pine in North Elmsley Township, Carleton Place District, and in 1 ha of 2-m red pine in North Crosby Township, Brockville District. Low populations were recorded in red pine plantations in Lanark Township, Carleton Place District, and in Osnabruck and Charlottenburgh townships, Cornwall District.

Light mortality (under 1%) was noted in a 1.5-ha plantation of 1.1-m red pine in Oxford on Rideau Township, Brockville District, and in a 2-ha plantation of 1.5-m red pine in North Elmsley Township, Carleton Place District.

Control operations were carried out by OMNR personnel in three districts on Woodland Improvement Act (WAI) and crown properties. The affected plantations were treated with ground applications of the viral insecticide Leconte virus at the recommended dosage of 5×10^9 PIB (polyhedral inclusion bodies)/ha and 10^{10} PIB/ha on third- and fourth-instar larvae. In all, six plantations comprising 38 ha were treated in the Brockville District. Two plantations totalling 10 ha were sprayed in Carleton Place District and one 0.4-ha plantation was treated in Tweed District.

Jack Pine Sawfly, *Neodiprion pratti paradoxicus* Ross

High populations were again observed in the region in 1986. The highest incidence of damage was recorded in the Brockville District but medium-to-heavy infestations were also encountered in Carleton Place and Tweed districts (Fig. 4), while light damage was detected in Napanee District.

Moderate-to-severe defoliation was recorded in jack pine (*Pinus banksiana* Lamb.) plantations in Augusta, Elizabethtown, Front of Yonge, Oxford on Rideau and Wolford townships, Brockville District. Three assessments typified the district situation. Evaluation disclosed that 73% of 2.4-m trees in a 5-ha plantation in Front of Yonge Township were damaged, and had an average of four colonies per tree. Similar damage was apparent in a 3-ha plantation in Elizabethtown Township where 47% of the 2.4-m trees were attacked, and had two colonies per tree. A windbreak consisting of 10, 7-m trees in Oxford on Rideau Township experienced an average defoliation of 80%.

Two areas were examined in Carleton Place District. Fifty-four percent of 3.3-m jack pine trees in a 10-ha plantation in Marlborough Township were infested with an average of one colony per tree. Defoliation averaged 10% on 0.3 km of 15-m fencerow jack pine in Lanark Township, Carleton Place District.

Table 5. Summary of redheaded pine sawfly colony counts at nine locations in the Eastern Region in 1986.

Location (Twp)	Host	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	No. of trees examined	Trees affected (%)	Avg no. of colonies per tree
Brockville District							
Oxford on Rideau	rP	1.1	2,500	1.5	150	10	2
Carleton Place District							
Marlborough	jP	1.3	1,700	5.0	150	1	1
Marlborough	jP	1.2	2,500	1.0	150	17	1
Bathurst	rP	2.0	2,500	2.0	150	30	1
Cornwall District							
E. Hawkesbury (Carillon Prov. Pk)	rP	2.3	*	0.5	60	27	1
Napanee District							
Portland	rP	2.1	2,500	0.5	150	19	1
Tweed District							
Abinger	rP	0.7	*	roadside	30	7	1
Denbigh	rP	2.5	2,500	1.0	150	35	1
Huntington	rP	1.7	2,500	0.4	150	59	2

* roadside or ornamental trees

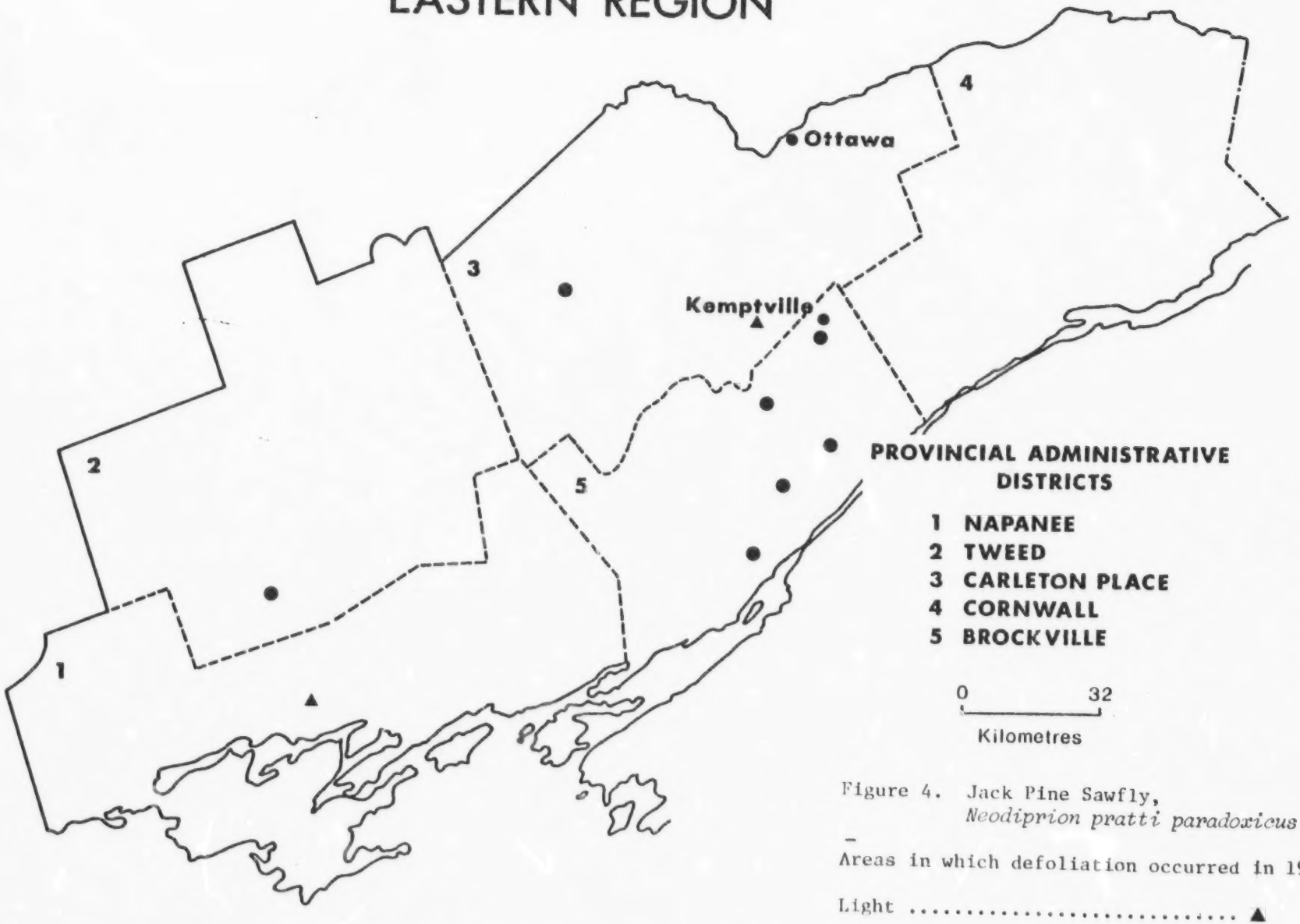


Figure 4. Jack Pine Sawfly,
Neodiprion pratti paradoxicus Ross

Areas in which defoliation occurred in 1986

Light ..... ▲

Moderate-to-severe ..... ●

High numbers attacked 77% of 2.9-m jack pine trees in a 5-ha plantation in Hungerford Township, Tweed District, causing 21% defoliation.

A light infestation was detected in a 1-ha plantation of 3-m jack pine trees in Tyendinaga Township, Napanee District.

European Pine Sawfly, *Neodiprion sertifer* (Geoff.)

Low numbers were observed at most locations in the region in 1986, although moderate-to-severe defoliation was recorded in three areas.

Defoliation averaged 80% on six 2-m roadside Scots pine (*Pinus sylvestris* L.) in North Crosby Township, Brockville District, and 2.5-m roadside Scots pine in Mountain Township, Cornwall District experienced up to 60% defoliation. Assessment of a 2-ha plantation of 4.5-m red pine in Marlborough Township, Carleton Place District disclosed that 72% of the trees were damaged, and had an average of two colonies per tree.

Low numbers were observed in a 3-ha plantation of 3-m Scots pine in Huntley Township, Carleton Place District. Light infestation was also detected on plantation and ornamental trees in Rear of Yonge and Escott, Oxford on Rideau and Wolford townships, Brockville District, and in Oso Township, Tweed District.

Bruce Spanworm, *Operophtera bruceata* (Hulst.)

The 20-ha area of moderate-to-severe defoliation recorded in 1985 in Pakenham Township, Carleton Place District was reinfested in 1986.

The most severely affected trees were sugar maple regeneration ranging in height from 15 cm to 30 cm. Ninety percent of the leaf surface of these trees was destroyed. Defoliation was also severe but more variable on trees 0.3 m to 10 m in height. Trees in this category experienced defoliation ranging from 5% to 90%. On the larger, 20-m dominant and codominant sugar maple, the heaviest damage occurred in the lower part of the crown and overall defoliation of these trees was less than 25%.

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

Previously high populations in the Brockville, Carleton Place, Napanee and Tweed districts collapsed in 1986. Observation disclosed that new small pockets of less than 1 ha of moderate-to-severe defoliation of 10-m to 20-m sugar maple were interspersed with larger areas of light defoliation in South Canonto Township, Tweed District. Low numbers were recorded in Rear of Leeds, Lansdowne, Front of Yonge and Leeds

townships, Brockville District, in Pakenham and Goulbourn townships, Carleton Place District, and in Olden and Effingham townships, Tweed District.

Minor Insects

Twig Pruner, *Elaphidionoides villosus* (F.)

Population increases were observed in the region. Comparable damage levels were last recorded in 1978.

The greatest impact was observed on roadside 12-m red oak (*Quercus rubra* L.) along Highway 401 west of Belleville. Examination of six of these trees disclosed that an average of 15 branches were "pruned" or broken off as a result of feeding activity. The branches varied in length from 0.3 m to 1 m.

Light damage was detected on ornamental red oak in Elizabethtown Township, Brockville District, and in Athol and Kingston townships, Napanee District. Evaluation of a 108-tree sample in a 10-ha stand of red oak with an average DBH of 26.5 cm in Lavant Township, Carleton Place District revealed that 21% of the trees were affected, and had one or two damaged branches.

Oystershell Scale, *Lepidosaphes ulmi* (L.)

This introduced pest was last reported in the region in 1980 at low numbers in the Brockville District. It is a sucking insect and high populations cause defoliation and branch mortality or weaken the host so that tree mortality may occur. Associated defoliation and damage assessments were conducted in two areas of moderate-to-severe damage.

The beech (*Fagus grandifolia* Ehrh.) component of a 1-ha mixed stand of beech and sugar maple in Lancaster Township, Cornwall District experienced moderate-to-severe defoliation. The highest numbers of scale insects were confined to a 0.5-ha area. Intermediate and understory trees were the most seriously affected, and associated defoliation averaged 30%, although trees with 90% defoliation were observed. Defoliation of 50% was also noted on some dominant and codominant trees 15 m to 20 m in height.

High populations were also encountered in a 10-ha stand of 18-m beech and sugar maple on the border of North Elmsley and North Burgess townships, Carleton Place District. The heaviest damage occurred on beech trees under 10 m in height. A defoliation estimate of 50 trees in this height class revealed an average defoliation of 50%. Ocular estimates of the dominant and codominant trees indicated an average defoliation of 25%, most of this damage occurring in the lower crown.

Mortality of buds and twigs was observed in both stands.

This pest was also detected causing light defoliation of beech in the Bob's Lake area of Tweed and Napanee districts.

Satin Moth, *Leucoma salicis* (L.)

High populations and associated moderate-to-severe defoliation of ornamental white poplar (*Populus alba* L.) and lombardy poplar (*Populus nigra* var. *italica* Muench.) were observed in two districts in the region.

Three 20-m lombardy poplars at one location in East Hawkesbury Township, Cornwall District experienced an average defoliation of 40%. The property owner had applied a chemical insecticide to limit potential defoliation. Five 15-m white poplar at another location in East Hawkesbury Township experienced an average defoliation of 90%. No control was instituted.

Surveys in Napanee District disclosed moderate-to-severe damage of three 15-m silver poplar in Hallowell Township and average defoliation of 60% of several 20-m white poplar in Sophiasburgh Township. Six 15-m white poplar in the town of Belleville experienced defoliation ranging from 20% to 40%.

Eastern Tent Caterpillar, *Malacosoma americanum* (F.)

High populations of eastern tent caterpillar recurred for the second consecutive year, causing severe defoliation of two of its deciduous hosts, apple (*Malus* spp.) and cherry (*Prunus* spp). Populations increased from east to west in the region. Napanee and Tweed districts hosted the highest numbers of this pest, as is evidenced by an assessment done in Elzevir Township, Tweed District, where 85 tents were counted in a 10-m x 10-m plot of 2-m cherry trees. Evaluations conducted in 10-m x 10-m plots of 1.5-m cherry trees in Front of Yonge Township, Brockville District, and Gloucester Township, Carleton Place District revealed counts of 16 and 20 tents, respectively. An assessment of 1-m cherry trees in East Hawkesbury Township, Cornwall District disclosed five tents in a 10-m x 10-m plot and typified the district situation.

Imported Willow Leaf Beetle, *Plagiodera versicolora* (Laich.)

High numbers of this imported skeletonizer were last recorded in 1984 in the Brockville and Cornwall districts. In 1986 severe foliar browning and defoliation of willows were observed across the region, especially on trees near major rivers such as the Trent, South Nation, Rideau, Mississippi and St. Lawrence. The imported willow leaf beetle was often found in conjunction with another serious pest of willow, the willow flea weevil, *Rhynchaenus rufipes* (Lec.).

Assessment of trees ranging in height from 10 m to 20 m along the north shore of Lake Ontario in South Fredericksburgh Township, Napanee District disclosed foliar damage up to 75%. A foliar damage estimate of 50 15-m willows along the Mississippi River in Pakenham Township, Carleton Place District indicated that 80% of the foliage was skeletonized. High populations were also recorded on willow along the Rideau River and Kemptville Creek in Oxford on Rideau Township, Brockville District and on willow whips in the G. Howard Ferguson Tree Nursery.

Willow Flea Weevil, *Rhynchaenus rufipes* (Lec.)

Medium-to-heavy infestations of this pest were observed attacking ornamentals and natural stands of willows in many parts of the region. All size classes of trees were affected. This insect was often found feeding in conjunction with the imported willow leaf beetle, and most willows in the region were attacked by one insect or both; in most instances total foliar damage resulted. Some areas in which complete foliar damage attributed to the willow flea weevil was detected were in Olden Township, Tweed District, Elizabethtown Township, Brockville District, and Charlottenburgh, Lancaster, Osnabruck and East Hawkesbury townships, Cornwall District.

Table 6. Other forest insects

Insect	Host(s)	Remarks
Acleris variana (Fern) Eastern blackheaded budworm	wS	1% defoliation of 5-m trees recorded in a plantation in Nepean Twp, Carleton Place District
Aphrophora cribrata (Wlk.) Pine spittlebug	jP wP	high populations (>10 spittle masses/tree) detected in a 5-ha plantation of 7-m eastern white pine in Hungerford Twp, Tweed District, and light infestations noted at many points in the region
Argyresthia thuiella (Pack.) Arborvitae leafminer	eC	low populations found at two locations in Brockville District, in the G. Howard Ferguson Forest Station in Oxford on Rideau Twp and in Rear of Yonge and Escott twps
Bucculatrix ainsliella Murt. Oak skeletonizer	bO	light infestations detected in Elizabethtown Twp, Brockville District

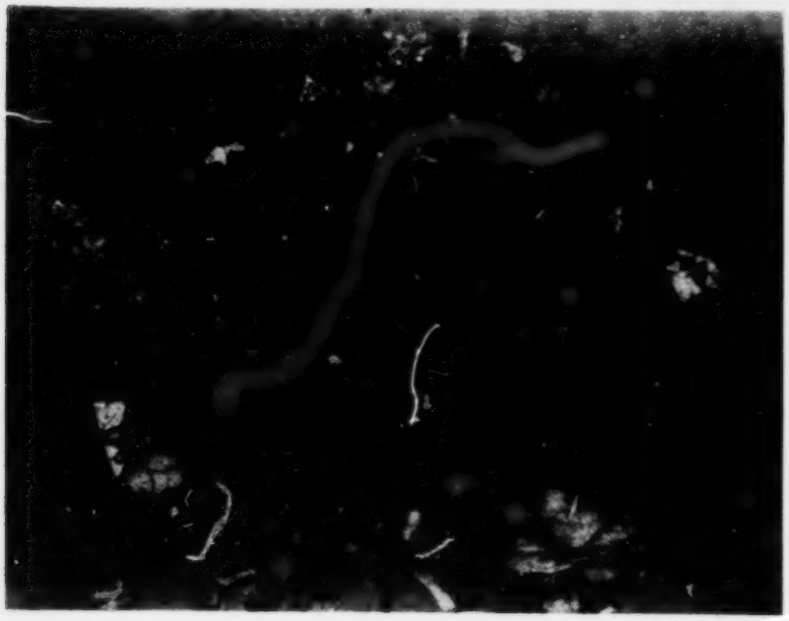
(cont'd)

Table 6. Other forest insects (cont'd)

Insect	Host(s)	Remarks
Cecidomyia resinicola (O.S.) (=reeksi Vock.) Jack pine resin midge	jP	4% of 2.4-m trees affected in a 3-ha plantation in Elizabethtown Twp, Brockville District
Choristoneura pinus pinus Free. Jack pine budworm	jP	light infestation recorded in a 10-ha plantation of 3-m trees in Marlborough Twp, Carleton Place District
Croesia semipurpurana (Kft.) Oak leaf shredder	rO	low numbers recorded in Kaladar and Kennebec twps, Tweed District
Croesus latitarsus Nort. Dusky birch sawfly	wB	50% defoliation of a 1.5-m tree in Oxford on Rideau Twp, Brockville District
Diprion similis (Htg.) Introduced pine sawfly	jP rP wP	low populations causing 1% defoliation in Madoc Twp, Tweed District, Tyendinaga Twp, Napanee District, Darling Twp, Carleton Place District, and Augusta, Elizabethtown and Front of Yonge twps, Brockville District
Ips pini (Say) Pine engraver beetle	rP wP	The insect was observed attacking single trees and groups of trees ranging in height from 3 m to 15 m in Cramahe Twp, Napanee District, Hungerford and Elzevir twps, Tweed District, and Lanark and Gloucester twps, Carleton Place District.
Malacosoma disstria Hbn. Forest tent caterpillar	rO	low numbers recorded in Kennebec and Kaladar twps, Tweed District
Megacyllene robiniae (Forst.) Locust borer	Lo	light infestation affecting 4-m trees in a plantation in Camden Twp, Napanee District

(cont'd)

Eutypella canker, *Eutypella parasitica* Davidson & Lorenz, affecting the trunk of a sugar maple (*Acer saccharum* Marsh.) tree



Anthracnose, *Discula* spp.: typical necrotic tissue on the leaf surface

Characteristic webmasses and defoliation of red pine (*Pinus resinosa* Ait.) caused by the pine false webworm, *Acantholyda erythrocephala* (L.)

Typical larval gallery and associated damage of the maple sugar borer, *Glycobius speciosus* (Say)

Table 6. Other forest insects (concl.)

Insect	Host(s)	Remarks
Messa nana (Klug) Early birch leaf edgeminer	wiB	100% foliar damage on several 9-m fencerow trees in Brighton Twp, Napanee District
Neodiprion abietis complex Balsam fir sawfly	bF	The insect was observed causing less than 5% defoliation on 74% of 2-m to 20-m trees in Fitzroy and Torbolton twps, Carleton Place District, and similar damage levels were recorded on 2-m to 15-m trees in Olden Twp, Tweed District.
Nymphalis antiopa (L.) Spiny elm caterpillar	E Po	low numbers collected in Oxford on Rideau Twp, Brockville District and Mountain Twp, Cornwall District
Petrova albicapitana (Busck) Northern pitch twig moth	jP	Lateral damage was recorded on 3% of 2-m trees in a 3-ha plantation in Elizabethtown Twp, Brockville District.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS	low populations detected in Nepean Twp, Carleton Place District
Pineus strobi (Htg.) Pine bark adelgid	wP	Light infestations affecting all size classes occurred in Lanark Twp, Carleton Place District, Augusta Twp, Brockville District, Mountain Twp, Cornwall District, and Hungerford Twp, Tweed District.
Schizura concinna (J.E. Smith) Redhumped caterpillar	aP	Low populations were recorded in Augusta Twp, Brockville District.
Synanthedon pini (Kell.) Pitch mass borer	wP wS	Assessment disclosed that 9% of 8-m trees in a 5-ha plantation in Hungerford Twp, Tweed District were affected and low numbers were collected from a 2-ha plantation of 9-m white spruce in Gloucester Twp, Carleton Place District.

TREE DISEASES

Major Diseases

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

The European race of Scleroderris canker has been detected in areas bordering the Eastern Region. To determine the status of this disease in the region in 1986, a special survey consisting of ground and aerial searches was conducted.

Ground surveys were carried out in 31 randomly selected plantations of mainly red pine of various age classes (Fig. 5). A minimum of 500 trees were examined in each stand; any suspect trees were sampled and the material was submitted to the Great Lakes Forestry Centre for identification.

An aerial survey of many of the pine plantations in the eastern part of the region was also undertaken. Plantations with damaged trees observed from the air were later ground checked.

Throughout the summer additional stands of pine were examined during routine pest surveys. The end result of all these surveys is that, to date, the European race of Scleroderris canker has not been found in the Eastern Region.

Anthracnose Diseases of Maples, *Aureobasidium apocryptum* (Ell. & Ev.) Hermanides-Nijhof, *Discula campestris* (Pass.) v. Arx, *Apiognomonia errabunda* (Roberge) Höhnel

The exceptionally wet season provided ideal conditions for the inoculation and spread of anthracnose fungi. The anthracnose pathogens overwinter in leaves on the ground and, with the advent of wet weather in the spring, produce spores that infect developing leaves. When moist conditions persist, the fungus on these infected leaves produces spores that infect other leaves. Moderate-to-severe infections were encountered throughout the region on fencerows, ornamental, roadside and fringe sugar maple (see photo page).

Evaluations of 25 15-m roadside sugar maple in Thurlow Township, Napanee District were typical of those for areas of high infection in the region. Assessment revealed that 88% of the trees were affected with foliar damage ranging from 5% to 100%, but averaging 35%. Similar foliar damage was recorded on roadside trees in Seymour Township, Napanee District, Palmerston Township, Tweed District, Charlottenburgh, Matilda, Osnabruck, Cornwall and Lancaster townships, Cornwall District, Osgoode, Goulbourn and Fitzroy townships, Carleton Place District, and Oxford on Rideau Township and Rear of Yonge and Leeds townships, Brockville District.

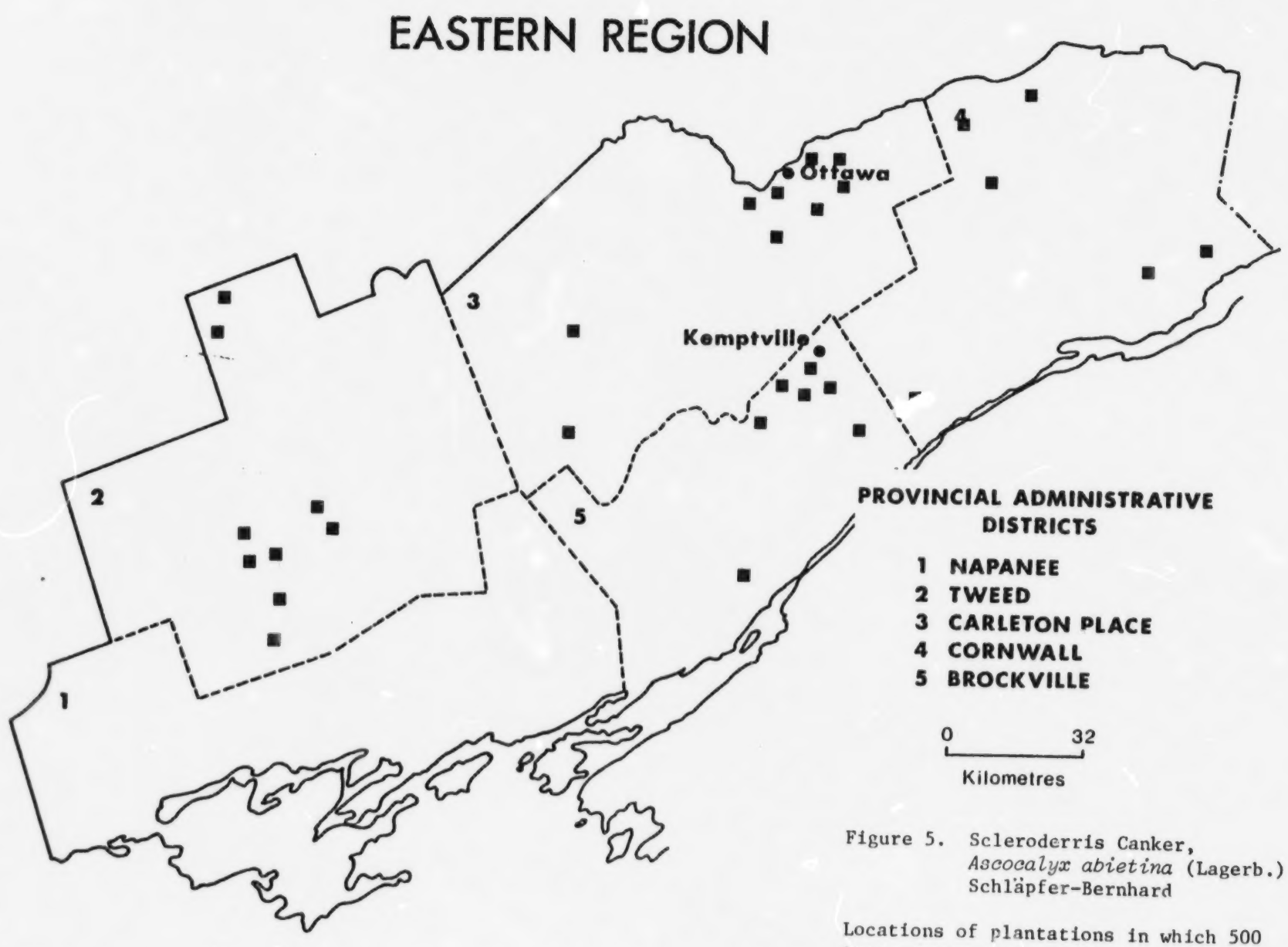


Figure 5. Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Locations of plantations in which 500 tree surveys were conducted in 1986.... ■

Typical damage to fringe sugar maple in forested areas was observed in North Sherbrooke Township, Carleton Place District, where 50% foliar damage occurred on occasional trees. Moderate-to-severe foliar infections ranging from 5% to 100% were observed on ornamental sugar maple in the towns or cities of Brockville, Merrickville, Ottawa, Belleville, Smiths Falls, Cornwall, Brighton and Colborne.

Eutypella canker, *Eutypella parasitica* Davidson & Lorenz

Five stands of sugar maple were evaluated to determine the incidence of this canker (see photo page). Diseased trees were encountered at three of the locations surveyed (Table 7). A minimum of 100 host trees were examined at each location.

Two affected trees were recorded in a survey of a 15-ha stand of 19-m sugar maple in Oxford on Rideau Township, Brockville District. One canker measured 1.0 m x 1.0 m and was 1.5 m above ground level while the other was 1.5 m x 0.6 m and was located at 1.0 m above the tree base. Another survey of 22-m trees in a 20-ha stand in Seymour Township, Napanee District disclosed one cankered tree. The canker measured 1.0 m x 0.4 m and was 3.5 m above ground level. A single damaged tree was observed in an evaluation of a 20-ha stand of 25-m trees in Effingham Township, Tweed District. The associated canker was 4.0 m above the tree base and measured 1.0 m x 0.6 m.

Table 7. Summary of the results of a Eutypella canker survey conducted at three locations in the Eastern Region in 1986 (data based on the examination of a minimum of 100 randomly selected host trees at each location).

Location (Twp)	Avg DBH (cm)	Avg ht (m)	Estimated area affected (ha)	Estimated host trees (ha)	Total no. of trees examined	No. of trees cankered
Brockville District						
Oxford on Rideau	29.6	19	15	320	100	2
Carleton Place District						
Goulbourn	33.3	24	10	200	103	0
Pakenham	33.4	21	50	320	102	0
Napanee District						
Seymour	29.7	22	20	545	101	1
Tweed District						
Effingham	32.3	25	20	280	108	1

Minor Diseases

Leaf Diseases of Ashes, *Apiognomonia errabunda* (Roberge) Höhnel,
Mycosphaerella effigurata (Schwein.) House,
Phyllactinia guttata (Wallr.:Fr.) Lév.

The entire component of natural and ornamental ash was affected by one of the following leaf diseases or a combination of them: *A. errabunda,* a leaf anthracnose, *M. effigurata,* ash leaf spot, and *P. guttata,* a powdery mildew. Foliar infections ranged from light to moderate-to-severe. Assessments done at the following four locations reflect the regional situation.

At one location in Marmora Township, Tweed District, assessment of 10-m fencerow trees disclosed average foliar damage of 20%. Examination of a 0.5-ha area of 5-m ash in Brighton Township, Napanee District revealed average foliar damage of 40%. The entire sample of 50 10-m trees in Ameliasburg Township, Napanee District was affected and defoliation averaged 30%. All of the 3-m ash in a 0.5-ha area in Montague Township, Carleton Place District experienced complete foliar damage or discoloration.

Pine Needle Rust, *Coleosporium asterum* (Dietel) Sydow

Low infections in the region in 1986 were comparable with those of the previous year. Three areas were assessed, and these typify the regional situation.

A high incidence of affected trees with accompanying light foliar damage was common in most plantations such as a 2-ha plantation of 3-m red pine in Madoc Township, Tweed District, where 78% of the trees were infected but only 1% of the foliage was damaged. A similar situation was encountered in a 3-ha plantation of 2.4-m jack pine in Elizabethtown Township, Brockville District, where 79% of the trees had 1% foliar infection. Foliar damage increased on trees planted in depressions or low, moist areas. Assessment in such an area of 1.8-m red pine in a 10-ha plantation in Front of Yonge Township, Brockville District disclosed that 82% of the trees had 9% foliar infection.

Balsam Poplar Leaf Diseases, *Linospora tetraspora* G.E. Thompson,
Mycosphaerella populorum G.E. Thompson,
M. populicola G.E. Thompson

The entire forest component of balsam poplar *(Populus balsamifera* L.) was severely affected by one or more of the following leaf diseases: *Linospora tetraspora,* linsopora leaf blight, *Mycosphaerella populorum,* septoria canker and *M. populicola,* leaf spot. Browning and premature defoliation were commonly observed in all host stands in the region. Complete defoliation of entire stands by the end of August was especially noticeable in the central portion of Brockville and Carleton Place districts.

One hundred host trees were specifically examined at three locations and total foliar damage on 100% of the sample was recorded in a 1-ha stand of 4-m trees in Lanark Township, Carleton Place District, in a 5-ha stand of 15-m trees in Goulbourn Township, Carleton Place District, and in a 1-ha stand of 5-m trees in Abinger Township, Tweed District.

Verticillium wilt, *Verticillium* spp.

This disease is chiefly a pest of ornamental maple that can cause branch, crown or whole-tree mortality. The causal fungus lives in the soil and infection usually occurs through the roots. Typical symptoms are sudden wilting, yellowing, then browning of the foliage of individual branches or the entire crown.

Three positive collections from ornamental sugar maple were made by the author. One sample was removed from a tree in the town of Colborne in Napanee District and was keyed out to *Verticillium dahliae* Kleb. Other collections of *Verticillium* spp. were taken from ornamentals in Rear of Yonge and Escott and Elizabethtown townships, Brockville District.

Verticillium spp. were positively identified from four collections submitted to the Great Lakes Forestry Centre in Sault Ste. Marie by OMNR staff on behalf of private individuals. The samples originated from ornamental maples in Clarence Township, Cornwall District, and the towns of Almonte, Brockville and Carleton Place.

Table 8. Other forest diseases.

Organism	Host(s)	Remarks
Ceratocystis ulmi (Buism) C. Moreau Dutch elm disease	E	At one location in Lancaster Twp, Cornwall District, 17% of 12-m fencerow and roadside trees were affected.
Cronartium ribicola J.C. Fischer White pine blister rust	wP	Evaluation disclosed 1% branch infections in plantations in Tyendinaga Twp, Napanee District, and Augusta Twp, Brockville District.
Diplodina acerina (Pass.) B. Sutton Diplodina leaf spot	rM	95% foliar damage to one tree on Wolfe Island, Napanee District

(cont'd)

Table 8. Other forest diseases (concl.)

Organism	Host(s)	Remarks
Heterobasidion annosum (Fr.) Bref. Fomes root rot	rP	four new pockets detected by OMNR personnel in La Rose Forest, Clarence Twp, Cornwall District
Hypoxylon mammatum (Wahlenb.) J. Miller	tA	In Gloucester Twp, Carleton Place District 6% of 14-m trees had stem cankers.
Kabatina thujae A. Schneider & v. Arx var. *juniperi* (A. Schneider & v. Arx) Morelet Needle blight	rJ	areas of branch and whole-tree mortality present south of Hwy 401, Napanee District
Marssonina brunnea (Ell. & Ev.) Magnus Marssonina leaf spot	hybrid poplar	a medium-to-heavy infestation noted in a 2-ha plantation of 5-m trees in Osnabruck Twp, Cornwall District
Marssonina castagnei (Desm. & Mont.) Magnus Marssonina leaf spot	sPo	100% foliar damage of 2-m to 20-m ornamentals observed in Williamsburg, Matilda and Osnabruck twps, Cornwall District
Marssonina juglandis (Lib.) Magnus Hickory leaf spot	Bu	70% defoliation of two 15-m trees recorded in Lancaster Twp, Cornwall District
Meria laricis Vuill. Larch needle cast	eL	This collection from a plantation of 3-m trees in Rear of Yonge and Escott Twp, Brockville District represents a new record in the Eastern Region.

DIEBACKS AND DECLINES

Maple Dieback Survey

A special survey was conducted in five randomly selected stands of sugar maple in the region. The purpose of this survey was to determine whether or not there were areas of excessive crown dieback not directly related to such factors as tree age and or site condition or to disturbance such as maple syrup production, logging, or pasturing of cattle. Two of the areas assessed were active maple sugar bushes and another had cattle trails throughout. A minimum of 100 trees were evaluated in each stand and current and cumulative branch mortality were estimated in five categories (Table 9). Current crown dieback is an estimate of the percentage of branches that have died in the current year (those that have the bark and most of the fine twigs still attached). Cumulative crown dieback is an estimate of the total percentage of crown dead or missing.

Assessment disclosed that 80% or more of the trees examined in all stands except the one in Seymour Township, Napanee District had less than 5% current branch mortality. The high level of branch mortality in Seymour Township was mostly site related. In all the stands examined, 95% or more of the trees had less than 20% current branch dieback. The survey also revealed that 74% or more of the trees in all of the five stands had less than 20% cumulative crown mortality. Recent whole-tree mortality was encountered in an area in Effingham Township, Tweed District.

Two of the areas evaluated in 1986 were examined in a similar survey done in 1984. The same stands were assessed but not the same trees within that stand. The comparable results are given in Table 10. Little change in the status of current branch mortality was observed between the two years.

Table 9. Summary of the results of a sugar maple stand survey conducted at five locations in the Eastern Region in 1986 (data based on the examination of a minimum of 100 host trees).

Location (Twp)	Avg DBH (cm)	Avg ht (m)	Estimated stand area (ha)	Estimated no. of host trees per ha	No. of trees examined	Crown dieback[a]											
						Current %						Cumulative %					
						0	1	2	3	4	5	0	1	2	3	4	5
Brockville District																	
Oxford on Rideau	29.6	19	15	400	100	90	10	0	0	0	0	50	37	12	1	0	0
Carleton Place District																	
Goulbourn	33.3	24	10	200	103	80	20	0	0	0	0	40	45	12	3	0	0
Pakenham	33.4	21	50	320	102	97	3	0	0	0	0	63	27	10	0	0	0
Napanee District																	
Seymour	29.7	22	20	545	101	66	29	3	2	0	0	28	46	20	4	2	0
Tweed District																	
Effingham	32.3	25	20	280	108	90	7	1	0	0	2	45	38	13	2	0	2

[a] Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >61%, 5 = dead trees.

Table 10. A comparison of the results of a sugar maple stand survey at two locations in the Eastern Region

Location (Twp)	Year	No. of trees examined	Crown dieback											
			Current %						cumulative %					
			0	1	2	3	4	5	0	1	2	3	4	5
Brockville District														
Oxford on Rideau	1984	106	89	6	3	0	0	2	70	21	7	0	0	2
	1986	100	90	10	0	0	0	0	50	37	12	1	0	0
Carleton Place District														
Goulbourn	1984	103	78	14	7	0	0	1	58	30	11	0	0	1
	1986	103	80	20	0	0	0	0	40	45	12	3	0	0

Oak Decline Plots

Reassessment of the two red oak plots established in Lavant Township, Carleton Place District in 1977 to monitor oak decline disclosed little change in crown deterioration from the previous year (Table 11). Whole-tree mortality, however, was recorded on both plots. In Plot 1 at Joe's Lake two of the three dead trees had been uprooted by high winds in 1984, and the other had been in category four of the Cumulative Crown Dieback rating system (>61% of crown dead) in 1984. The two dead trees recorded in Plot 2 had also been in category four the previous year and had died during the winter.

Increased defoliation by the gypsy moth was observed in Plot 1. Visual estimates indicated that each plot tree was affected with defoliation ranging from 5% to 60%, but averaging 20% over all. Low numbers only were recorded in the other plot.

Table 11. Summary of the 1984, 1985 and 1986 results from two plots established in 1977 to monitor red oak decline in the Eastern Region (data based on the examination of a minimum of 100 host trees at each location).

Location (Twp)	Avg DBH of sample trees (cm)	Estimated stand size (ha)	Year	Crown dieback[a] Current %						Cumulative %					
				0	1	2	3	4	5	0	1	2	3	4	5
Carleton Place District															
Lavant Plot 1 Joe's Lake	26.5	40	1984	10	51	20	6	6	0	0	26	43	15	5	7
			1985	36	35	14	7	1	0	0	26	47	15	5	7
			1986	43	35	11	1	0	3	0	30	42	12	6	10
Plot 2 Flower Station	21.9	15	1984	19	48	18	3	2	0	0	19	49	19	3	0
			1985	48	37	3	0	2	0	0	31	47	11	1	0
			1986	42	39	7	0	0	2	0	39	43	4	2	12

[a] Dieback classification: 0 = 5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = > 61%, 5 = dead trees

ABIOTIC DAMAGE

Frost Damage

Low temperatures were experienced throughout the region on 3 June. Ottawa and Kingston weather stations reported daily minimum temperatures of 2.4°C and 1.4°C, respectively. These low temperatures caused varying levels of foliar damage to planted trees and natural regeneration across the region. Each OMNR district office reported foliage discoloration in European larch, eastern white pine and red pine plantations. Other affected tree species included red maple (*Acer rubrum* L.), poplar, balsam fir (*Abies balsamea* [L.] Mill.), ashes and tamarack. The following observations and quantitative data are typical for the region.

Assessments were conducted in eastern white pine, red pine and European larch plantations in four areas; foliar damage ranged from 5% on 2-m eastern white pine in Darling Township, Carleton Place District to 20% on 1.1-m red pine in Oxford on Rideau Township, Brockville District (Table 12). An assessment was also done in a 1-ha area of 1.5-m black ash in Tyendinaga Township, Napanee District, where the complete 100-tree sample was affected and defoliation averaged 15%. Frost also damaged lateral and terminal shoots of 15% of the Norway spruce (*Picea abies* [L.] Karst.) in Compartment A4 at the G. Howard Ferguson Forest Station.

Porcupine Damage

Porcupines (*Erethizon dorsatum* L.) were responsible for varying degrees of damage in four plantations examined in the region. Examination of a 5-ha plantation of 9-m red pine in Gloucester Township, Carleton Place District, revealed a pocket of six trees that had been girdled and, as a result, each had about 2 m of top kill. A 3-ha plantation of 11-m eastern white pine in Lanark Township, Carleton Place District had 3% of the trees partially girdled. Assessment disclosed that 1% of 8-m eastern white pine in a 5-ha plantation in Hungerford Township, Tweed District were also partially girdled. The most serious damage was observed in a 1.5-ha plantation of 7-m red pine in Oxford on Rideau Township, Brockville District, where 38% of the trees were girdled but still living, and 11% were dead.

Table 12. Summary of damage caused by frost in four districts in the Eastern Region in 1986.

Location (Twp)	Host	Avg ht of trees (m)	Estimated trees per ha	Estimated area affected (ha)	No. of trees examined	Trees affected (%)	Foliar damage (%)
Brockville District							
Oxford on Rideau	rP	1.1	2,500	2	150	45	20
Augusta	wP	1.4	2,350	3	150	65	11
Carleton Place District							
Darling	wP	2.0	2,116	4	150	21	5
Napanee District							
Tyendinaga	bAs	1.5	1,000	1	100	100	15
Tweed District							
Huntington	eL	2.0	2,000	1	50	88	5

Salt damage

This problem was common wherever susceptible tree species such as red pine, eastern white pine or eastern white cedar (*Thuja occidentalis* L.) were growing in close proximity to major traveled routes that were treated with deicing salt during the winter. The most spectacular example of this was in a 9-ha mixed plantation of 10-m red pine and eastern white pine at the junction of Highway 417 and Anderson Road in Gloucester Township, Carleton Place District, where about 4 ha were severely affected and exhibited 100% foliar damage.

Wind damage

High winds on 16 June resulted in widespread damage in the region. The damage manifested itself as single-tree blowdown or the destruction of large areas of timber. The largest single area of blowdown was in Clarendon Township, Tweed District, where 40 ha of merchantable eastern white pine, sugar maple and poplar were blown down. Eight stands of sugar maple in North Sherbrooke Township, Carleton Place District experienced similar damage. OMNR personnel estimated that a total of 64 ha of sugar maple were wind damaged; consequently, 1,298 cords of timber and 2,948 potential maple syrup taps were destroyed.

Excessive wind damage, in the form of wind whip, was observed in some plantations. Evaluation of a 2-ha plantation of 3-m red pine in Madoc Township, Tweed District revealed that 5% of the trees were affected: 3% of the trees had broken terminals and 2% had damaged laterals.

SPECIAL SURVEYS

Eastern White Pine Plantations

A special survey was conducted in six eastern white pine plantations in the Eastern Region to assess the types of pest problems and their impact (Fig. 6). Two plantations were selected from each of the following three height classes: 0.5 m to 2 m, 2.1 m to 6.0 m and > 6.0 m. At each location, 150 trees were examined (Table 13). Two visits were made to each area: the first was completed by 15 June and the second was during the period 14 July to 15 August. The plantations were evaluated to detect the presence of the following selected insects and diseases.

Insects: white pine weevil, *Pissodes strobi* (Peck), eastern pine shoot borer, *Eucosma gloriola* Heinr., pine spittlebug, and pine bark adelgid.

Diseases: Armillaria root rot, *Armillaria mellea* (Vahl:Fr.) Kummer and white pine blister rust.

With the exception of Armillaria root rot, all of the selected pests were found.

Other insects, diseases and abiotic damage not specifically designated as part of the survey were also assessed when found and, except for frost, none was responsible for appreciable damage (see below).

Insects: pine false webworm, chameleon caterpillar, *Anomogyna elimata* (Gn.), a webspinning sawfly, *Cephalcia* spp., white pine aphid, *Cinara strobi* (Fitch), webbing coneworm, *Dioryctria disclusa* Heinr., introduced pine sawfly, pine engraver, false hemlock looper, *Nepytia canosaria* (Wlk.), northern pine weevil, *Pissodes approximatus* Hopk., pitch mass borer, and pine needle sheath-miner, *Zellaria haimbachi* Bsk.

Diseases: No miscellaneous diseases were encountered.

Abiotic damage: porcupines and frost

A comparison of the results of a similar survey conducted in six different eastern white pine plantations in 1983 and those of the more recent one are listed below.

Populations of the pine spittlebug increased in the 1986 survey. In 1983, four plantations were attacked and trees affected averaged 12%; in 1986, the pest was also recorded in four plantations but the trees affected averaged 32%.

The number of leaders attacked by the white pine weevil increased in 1986, when three plantations were infested and leaders attacked averaged 6%. The same number of plantations was infested in 1983 but damaged leaders averaged only 2%.

Evaluation disclosed a decrease in the incidence of leader attack by the eastern pine shoot borer in the current survey. In the previous survey an average of 4% of the leaders were damaged in five plantations, while in 1986, average leader damage was 3% in two areas.

A large increase in the incidence of attack by the pine bark adelgid was recorded in the current survey. The average number of trees infested in 1986 was 44% in four plantations. In 1983, only 9% of the trees were attacked in five areas.

An increased incidence of white pine blister rust was noted in the present survey. Four plantations were infested in 1986 and trees affected averaged 2%. In 1983, only one plantation was affected, and 1% of the trees were damaged.

Armillaria root rot was detected in three plantations in 1983 but it was not found at all in 1986.

Only one basal stem canker (other than those caused by white pine blister rust) was found in the 1986 survey while six cankered trees were found in 1983. No causal agents could be determined in either survey.

Frost attacked an average of 43% of the trees in two plantations in 1986 and 5% of the trees in four areas in 1983.

Eastern White Pine Cone Collection

A special collection of 100 second-year cones in the green succulent stage was made in the first week of July from 10 trees in a 25-year-old eastern white pine Seed Collection Area in Gloucester Township, Carleton Place District.

Dissection revealed that 12% of the cones were damaged by insects. Mean seed count in the undamaged cones was 40 while the mean seed count in the damaged cones was 38, for a total seed loss of 5%. The responsible agents in order of importance were: a midge, *Resseliella* spp., white pine coneworm, *Eucosma tocullionana* Heinr. and an unknown agent.

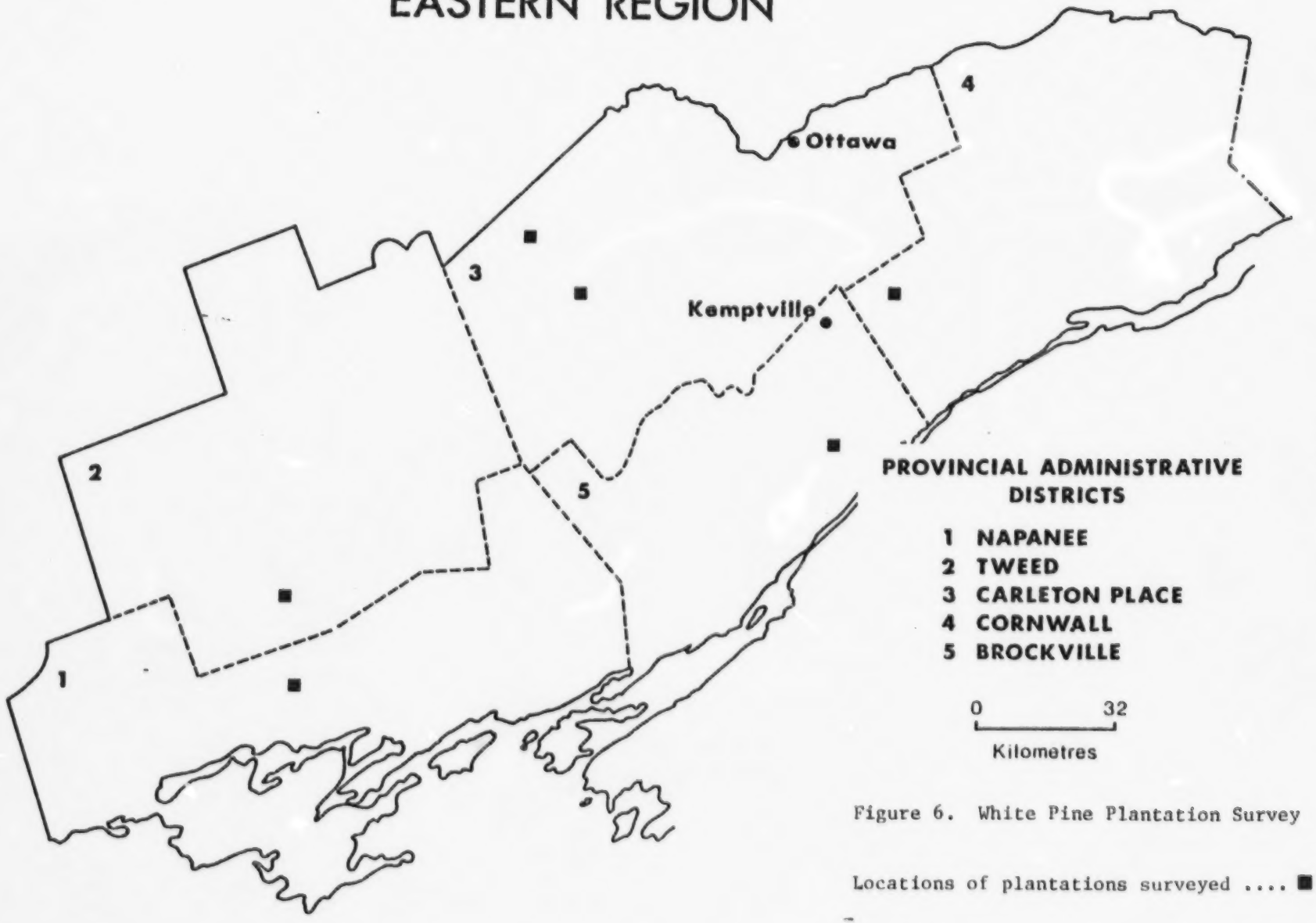


Figure 6. White Pine Plantation Survey

Locations of plantations surveyed .... ■

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 13. Summary of the results of an eastern white pine plantation survey conducted at six locations in the Eastern Region (counts based on the examination of 150 trees at each location)

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Pine spittlebug		White pine weevil	Eastern pine shoot borer		Pine bark adelgid	
				Trees affected (%)	Avg no. of colonies/ affected tree	Leaders attacked (%)	Leaders attacked (%)	Laterals attacked (%)	Trees affected (%)	Population density (L, M, H)[a]
Brockville District										
Augusta	3	2,350	1.4	11	2	0	0	0	1	L
Carleton Place District										
Darling	4	2,116	2.0	11	1	12	4	13	0	0
Lanark	3	1,500	10.7	0	0	0	0	0	83	L
Cornwall District										
Mountain	2	1,875	6.1	0	0	1	0	0	47	L
Napanee District										
Tyendinaga	5	2,500	1.7	4	1	5	2	1	0	0
Tweed District										
Hungerford	5	2,000	7.5	100	10	0	0	0	45	L

L = low, M = moderate, H = high

(cont'd)

Table 13. Summary of the results of an eastern white pine plantation survey conducted at six locations in the Eastern Region (counts based on the examination of 150 trees at each location) (concl.)

Location (Twp)	Estimated stand area (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	White pine blister rust		Armillaria root rot	Basal stem cankers	Frost	
				Trees affected (%)	Stem cankers (%)	Trees affected (%)	Trees affected (%)	Trees affected (%)	Foliar damage (%)
Brockville District									
Augusta	3	2,350	1.4	1	7	0	0	65	11
Carleton Place District									
Darling	4	2,116	2.0	0	0	0	0	21	5
Lanark	3	1,500	10.7	0	0	0	0	0	0
Cornwall District									
Mountain	2	1,875	6.1	3	3	0	0	0	0
Napanee District									
Tyendinaga	5	2,500	1.7	1	0	0	1	0	0
Tweed District									
Hungerford	5	2,000	7.5	3	3	0	0	0	0

G. Howard Ferguson Forest Station

Insects: Low populations of first- and second-generation arborvitae leafminer were detected on cedar windbreaks and light infestations of the little spruce sawfly, *Pristiphora lena* Kinc., and the eastern spruce gall adelgid, *Adelges abietis* (L.), were collected from spruce windbreaks.

Examination of a burlap larval trap on a white oak in Compartment 61 revealed as many as 55 gypsy moth larvae.

High numbers of spotted poplar aphid, *Aphis maculatae* (Oestl.), attacked occasional hybrid poplar (*Populus* spp.) in several compartments. Light damage by the poplar leafgall sawfly, *Phyllocolpa* (= Pontania) *populi* (Marl.), was observed on hybrid poplar in Compartment 65 and the willow shoot sawfly, *Janus abbreviatus* (Say), attacked 5% of the main stems of the poplar in Compartment B3.

High populations of willow gall sawflies, *Pontania* spp., up to 12 galls per leaf, infested one type of willow clone, and the imported willow leaf beetle, *Plagiodera versicolora* (Laich.), severely skeletonized another willow clone. Low numbers of the imported willow leaf beetle were also observed on hybrid poplar.

Diseases: A large component of the hybrid poplar was attacked by *Fusarium* spp. fungi that live saprophytically in the soil, but under certain conditions may become pathogenic. The following clones were affected: NM, DN, DTAC, JAC, MAX, AK, AS, and C. Surveys done by OMNR showed that the percentage of productive stools infected ranged from <1% to 21%. Diseased stools were removed as a control measure. Low infections of *Fusarium* spp. were recovered from white spruce in Compartment 25 and from eastern white pine in Compartment 24 and Compartment A11.

Light terminal and lateral damage caused by a shoot blight, *Venturia populina* (Vuill.) Fabric., was recorded on hybrid poplar in Compartment A3.

Medium-to-heavy infections of the larch-poplar rust, *Melampsora medusae* Thum., were found affecting the following hybrid poplar clones: DN66, DN76, DN94, DN184, DTAC4, DTAC10 and DTAC24.

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

The first record of this pest occurred in 1984 in the Eastern Region and as a result, several trees displaying typical symptoms of attack such as wilt, chlorotic foliage or the presence of blue stain in the sapwood were sampled in 1985. Positive identification was made from samples taken from three locations in the region in 1985. The pinewood nematode was recovered from a red pine in Oxford on Rideau Township, Brockville District, from red pine in Denbigh Township, Tweed District, and from eastern white pine and red pine in Fitzroy Township, Carleton Place District. There are still samples in the process of being identified.

Four samples, three from Clarence Township, Cornwall District, and one from Elzevir Township, Tweed District, were submitted in 1986. No nematodes were recovered from two of the samples in Clarence Township. The other two submissions are being processed.

Acid Rain National Early Warning System (ARNEWS)

The three ARNEWS plots, one located in a stand of sugar maple in Rear of Yonge and Escott Township, Brockville District, another in a white spruce plantation in Gloucester Township, Carleton Place District, and another in an eastern white pine plantation in Hungerford Township, Tweed District, were revisited in 1986. Some of the quantitative and qualitative data retrieved from the plots included information on individual tree condition, branch condition, seed production, acid rain symptoms, foliar damage and stem damage. The regeneration on three subplots was examined, heights were taken, a visual assessment was made and a collection was made of the various types of ground vegetation on each plot.

Climatic Data

Weather plays an important role in the development of insect and disease pests. Temperature and moisture extremes also affect tree physiology. For these reasons weather data are gathered from weather observation stations across the province. Monthly temperature and precipitation records, their normal values and the deviation from normal for two locations in the Eastern Region are summarized in Table 14.

Table 14. A comparison of mean temperatures and total precipitation and their normal values (based on a 30-year period), at the Ottawa International Airport in 1986

Month	Mean temp. 1986 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1986 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	- 9.8	-10.9	+1.1	54.0	61.0	- 7.0
Feb.	- 9.7	- 9.5	-0.2	37.6	60.3	-22.7
Mar.	- 1.5	- 3.0	+1.5	59.0	67.5	- 8.5
Apr.	9.0	5.6	+3.4	36.0	69.1	-33.1
May	14.2	12.8	+1.4	164.3	67.9	+96.4
June	16.3	18.0	-1.7	107.0	73.4	+33.6
July	20.1	20.6	-0.5	144.4	85.9	+58.5
Aug.	18.0	19.2	-1.2	99.0	88.4	+10.6
Sept.	13.3	14.3	-1.0	167.6	79.3	+88.3
Oct.	7.7	8.1	-0.4	78.0	68.1	+ 9.9
Nov.	-0.5	1.2	-0.7	46.8	77.7	-30.9
Dec.	-4.8	- 7.7	+2.9	93.8	80.7	+13.1

Table 14. A comparison of mean temperatures and total precipitation and their normal values (based on a 30-year period), at the Ottawa International Airport in 1986

Month	Mean temp. 1986 (°C)	Normal temp. (°C)	Deviation from normal temp. (°C)	Total precip. 1986 (mm)	Normal precip. (mm)	Deviation from normal precip. (mm)
Jan.	- 7.4	- 7.7	+0.3	54.2	69.3	-15.1
Feb.	- 8.8	- 7.0	-1.8	59.0	58.9	-+0.1
Mar.	- 0.8	- 1.6	+0.8	78.8	71.7	+ 7.1
Apr.	8.0	5.5	+2.5	48.8	69.9	-21.1
May	11.4	11.4	0.0	80.6	71.0	+ 9.6
June	15.6	16.7	-1.1	131.6	64.0	+67.6
July	19.6	20.1	-0.5	74.6	53.2	+21.4
Aug.	18.4	19.4	-1.0	129.2	76.2	+53.0
Sept.	14.1	15.4	-1.3	174.4	80.9	+93.5
Oct.	8.7	9.4	-0.7	81.8	77.1	+ 4.7
Nov.	- 2.1	3.4	-1.3	74.6	84.0	- 9.4
Dec.	- 1.3	- 4.2	+2.9	110.2	91.1	+19.1